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(54) Abstract Title  
**Applying a pattern to a wood-based material**

(57) A method of applying a pattern to the surface of a wood-based material, such as medium density fibreboard, comprises screen printing the pattern on the surface using an ultraviolet-curable ink, examining the printed ink for imperfections and, if no imperfections are visible, curing the ink using ultraviolet light. A plurality of different colours of ultraviolet-curable ink may be printed and cured sequentially, the removal of an uncured colour using a solvent not affecting a previously cured colour.

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APPLYING A PATTERN TO A SUBSTRATE

The present invention relates to a method of applying a pattern to a substrate and more particularly to a method of applying a pattern to the surface of a wood-based material.

The term "wood-based material" encompasses such materials as medium-density fibreboard (MDF), plywood, wood and chipboard. The invention is particularly suitable for screen printing on MDF and it is believed that no satisfactory method for doing so has hitherto been proposed.

In order to give wood-based composite materials the appearance of natural wood, it is usual to apply, as a laminate, a layer of paper or plastics veneer or a foil or transfer bearing a wood-grain pattern. The pattern may firstly be applied to the veneer or foil by screen printing. The subsequent lamination step adds significantly to manufacturing costs and the laminated layer may not be colour fast and may be damaged, in use, particularly if subjected to heat.

Attempts have therefore been made to screen print directly on to the surface of the wood-based material. However, imperfections can arise due to bubbles in the ink or particles of dust or dirt. Typically, four different colours of ink (yellow, cyan, magenta and black) are printed sequentially and imperfections in any of the four applications are immediately apparent in the finished article.

It is an object of the invention to provide a practicable method of screen printing directly on to the surface of a wood-based material in which visible imperfections can be eliminated and in which the appearance can be enhanced by producing digital origination and screen

line counts being not less than 30 dots p r cm.

Accordingly, the present invention provides a method of applying a pattern to the surface of a wood-based composite material, comprising the steps of screen printing the  
5 pattern on the surface of the material using an ultraviolet- (UV-) curable ink, examining the printed ink for imperfections and, if no imperfections are visible, curing the ink using UV light.

Preferably, if imperfections are visible, the printed  
10 but uncured ink is removed from the substrate by dissolving it in a suitable solvent.

Preferably, a plurality of different colours of ink are printed sequentially. For example, an initial plain white layer may be printed, followed by yellow, cyan, magenta and  
15 black inks (not necessarily in that order) defining the pattern. This leads to the considerable advantage that each differently coloured application of ink can be checked for imperfections and cured if none are present. If  
20 imperfections are present in the second or a subsequent colour, that application of ink can be removed by dissolution without affecting the previously printed and cured colour(s), which are entirely resistant to the solvent.

Preferably, a concentrated UV-curable ink is used, to  
25 which an amount of base is added to give an ink of usable consistency but which still cures when subjected to UV light.

In a preferred embodiment of the invention, the pattern is a wood-grain pattern derived from an original veneer,  
30 piece of wood or marquetry design. Such a pattern may be photographed on film, or digitally at high resolution. The image achieved is then either electronically scanned or down-loaded onto a suitable computer. The image is then

adjusted or enhanced to meet required colour balance for the printed reproduction. The image is then screened, preferably with at least 30 dots per cm, and projected as film positives, one film for each specific colour to be  
5 printed.

The present invention also provides an item of furniture made of a wood-based material, to which a pattern has been applied by the method of the invention.

A preferred embodiment of the invention will now be  
10 described in more detail by way of example only.

The printing silk screens used in the process of the invention are produced in a conventional manner. An original veneer or piece of wood or marquetry is selected, photographed or digitally imaged at high resolution. The  
15 image is transferred to a computer which produces a full colour visual representation of the pattern to be printed. The image is electronically passed through an image setter which breaks the image into dots of not less than 30 dots per cm. The image setter separates each primary colour and  
20 produces a monochrome film for each colour together with a black positive image.

Next, the yellow film positive is placed over a suitably sized frame over which a screen of silk, or an artificial silk substitute, has been stretched with a  
25 uniform tension of 379 N (85 lb) exerted uniformly throughout the screen. The screen is coated with a light-sensitive emulsion which permeates therethrough. When the emulsion is dry, ultraviolet light is shone through the film positive at the screen, exposing only those parts of the  
30 screen not overlain by the pattern. The parts which are overlain by the pattern are not exposed and remain black, thus creating on the screen a black image of the yellow pattern. A fine jet of water is then directed at the screen, and since where the unexpected black pattern exists

the emulsion is soft, at these points clear regions of the screen are created which are permeable to screen printing ink.

5 The steps described in the previous paragraph are repeated using the cyan, magenta and black film positives and any additional positives necessary to achieve the production quality sought.

10 An essential requirement of the invention is that UV-curable ink is used for the screen printing process. Those skilled in the art of screen printing will understand what is meant by the term "UV-curable ink" (or simply "UV-ink"). In the preferred embodiment, a concentrated UV-ink is used. Unlike the thin UV-ink used for screen printing of posters and the like, this ink is extremely viscous and is supplied  
15 with a suitable base of low viscosity. A quantity of the ink is mixed with the base. Before commencing the printing process, some of the mixed ink is applied to an MDF substrate and a UV drier is used to check that proper curing occurs.

20 The first application of UV-ink to the MDF substrate is a plain white layer which serves to seal the surface and cover the original colour of the MDF. After the white ink has been applied, a careful examination is made to check for imperfections such as bubbles and specks of dust. Any such  
25 imperfections would cause obvious flaws in the finished pattern. If any imperfections are visible, the white layer is removed by dissolving the ink using a suitable solvent or thinner. Only when no imperfections can be seen is the white UV-ink cured using a UV drier.

30 When the white layer is dry, yellow UV-ink is then applied through the appropriate silk screen to create a yellow pattern on top of the white layer. The yellow pattern is then carefully examined for imperfections. If any imperfection is detected, the yellow ink is removed by

dissolving it in a suitable solvent or thinner. This solvent has no effect on the underlying white ink due to the fact that the latter has been cured with UV radiation. The yellow pattern of UV ink is then reapplied and the process  
5 repeated until no imperfections are visible, whereupon the yellow ink is cured using a UV drier.

The cyan, red and black UV-inks are applied through their respective screens in the same manner as the yellow ink. If, after a particular colour of ink has been applied,  
10 any imperfections are detected, that colour of ink can be removed, without affecting the previously-applied colours, and then reapplied.

It will be appreciated that the disadvantages of prior art methods of applying a pattern to materials such as MDF  
15 have been overcome by the present invention. A further advantage of using UV-inks is that they are quick-drying and make possible the use of more dots per cm on the silk screen improving the printing quality.

Whilst a particular embodiment of the invention has  
20 been described, modifications will readily occur to those skilled in the art which do not depart from the scope of the invention. For example, the differently-coloured UV-inks may be applied in a different order to that specified above.

CLAIMS

1       A method of applying a pattern to the surface of  
a wood-based material, comprising the steps of screen  
printing the pattern on the surface of the material using an  
5 ultraviolet-curable ink, examining the printed ink for  
imperfections and, if no imperfections are visible, curing  
the ink using ultraviolet light.

2       A method as claimed in claim 1, wherein, if  
imperfections are visible, the printed ink is removed from  
10 the surface of the material by dissolving it in a suitable  
solvent, and the step of screen printing is repeated.

3       A method as claimed in claim 1 or 2, wherein a  
plurality of different colours of ultraviolet-curable ink  
are printed sequentially.

15       4       A method as claimed in claim 3, comprising the  
steps of printing a first colour of ink, examining the  
printed ink for imperfections, removing said first colour of  
ink if imperfections are visible and reprinting said first  
colour, curing said first colour of ink when no  
20 imperfections are visible, and repeating the steps of  
printing, examining, if necessary removing and reprinting  
and curing with at least one further colour of ink.

5       A method as claimed in any preceding claim,  
wherein the ultraviolet curable ink is formulated just prior  
25 to the printing step by mixing a concentrated ink and a  
suitable base.

6       A method as claimed in any preceding claim,  
wherein the pattern to be applied is digitally imaged and  
enhanced from an original veneer or piece of wood or  
30 marquetry.

7       A method as claimed in claim 6, wherein the



resolution is approximately 30 dots per cm.

8 A method as claimed in any preceding claim,  
wherein the wood-based material is medium-density  
fibreboard, chipboard or plywood.

5 9 A method of applying a pattern to the surface of  
a wood-based material, substantially as hereinbefore  
described.

10 10 An item of furniture made from a wood-based  
material, to the surface of which a pattern has been applied  
10 by a method as claimed in any preceding claim.



The  
Patent  
Office

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Application No: GB 9720878.9  
Claims searched: 1-10

Examiner: Meredith Reynolds  
Date of search: 21 January 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B6C(CST)

Int Cl (Ed.6): B41M 1/12, 1/38 G03F 7/12

Other: WPI:Online

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2212761A (Roberts)(whole doc)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.